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Transmission systems

Edited by

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Chapter 2

Transmission principles

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2.1 Introduction

Transmission systems exist to provide circuits for transmitting speech and other signals between the nodes of a telecommunication network. A *circuit* provides for the transmission of these signals in both directions. If the circuit uses a separate transmission path for each direction, then each of these unidirectional paths is called a *channel*. In general, a complete channel consists of sending equipment at a *terminal station*, a *transmission link*, which may contain repeaters at *intermediate stations*, and receiving equipment at another terminal station.* Present-day transmission systems [1, 2, 3] range in complexity from simple unamplified audio-frequency lines to satellite radiocommunication systems.

Both transmission channels and the signals they convey may be classified in two broad classes: *analogue* and *digital*. An analogue signal is a continuous function of time; at any instant it may have any value between limits set by the maximum power that can be transmitted. Speech signals are an obvious example. A digital signal can only have discrete values. The commonest digital signal is a binary signal, having only two values (e.g. 'mark' and 'space' or '1' and '0'). Telegraph signals and outputs of binary-coded data from computers are thus digital signals. A television waveform is a mixture of analogue and digital signals, since it transmits both the picture contents and synchronising pulses. Some analogue and digital signals that are transmitted in telecommunication networks are listed in Table 2.1.

A signal consisting of a single sinusoidal waveform is completely predictable; thus it conveys no information. A useful analogue signal must therefore contain a range of frequencies; this is known as its *bandwidth*. For a digital signal, the number of signal elements transmitted per second is called the signalling rate in *bauds*. If a non-redundant binary code is used, the rate of transmission of information (in bits per second) equals the signalling rate in bauds. If the coding contains redundancy, the bit rate is less than the number of bauds. If a multilevel signal is used (e.g. ternary or quarternary), each element conveys more than one bit of information; the bit rate is thus greater than the number of bauds.

* In practice, a building that houses any kind of transmission equipment is usually called a *repeater station*.